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Australian Standard®
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MAXIMUM EXPOSURE LEVELS—RADIO-FREQUENCY RADIATION—300 kHz TO 300 GHz

STANDARDS ASSOCIATION OF AUSTRALIA
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This Australian standard was prepared by Committee TE/7, Hazards of Non-ionizing Radiation. It was approved on behalf of the Council of the Standards Association of Australia on 31 November 1984 and published on 31 January 1985.

The following interests are represented on Committee TE/7:

Australian Electronics Industry Association
Australian Radiation Laboratory
Australian Radiation Protection Society
Consumer Electronics Suppliers Association
CSIRO, Division of Applied Physics
Department of Aviation
Department of Communications
Department of Defence
Department of Health
Department of Health, Qld
Department of Industrial Relations, N.S.W.
Institution of Radio and Electronics Engineers Australia
Telecom Australia
Wireless Institute of Australia

This standard was issued in draft form for comment as DR 82191.

AUSTRALIAN STANDARD

~~MAXIMUM EXPOSURE LEVELS—RADIO-FREQUENCY RADIATION—300 kHz TO 300 GHz~~

RADIO FREQUENCY RADIATION SEE AMENDMENT 1

Part 1 - MAXIMUM EXPOSURE LEVELS — 300 kHz TO 300 GHz

AS 2772.1—1985

First published.....1985

PUBLISHED BY THE STANDARDS ASSOCIATION OF AUSTRALIA
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AMENDMENT No 1
to
AS 2772—1985
MAXIMUM EXPOSURE LEVELS—
RADIO FREQUENCY RADIATION—
300 kHz TO 300 GHz

CORRECTION

The 1985 edition of AS 2772 is amended as follows; the amendment(s) should be inserted in the appropriate place.

SUMMARY: This amendment applies to the title of the Standard.

Published on 7 March 1988.

AMDT No 1 MAR. 1988

Cover. Title.

Page 1. Title.

Page 4. Title.

Delete existing title and *substitute*:

RADIO FREQUENCY RADIATION
Part 1—MAXIMUM EXPOSURE LEVELS— 300 kHz TO 300 GHz

First published.....1985

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PREFACE

This standard was prepared by the Association's Committee on the Hazards of Non-ionizing Radiation. It covers electromagnetic radiation with a frequency range of 300 kHz to 300 GHz. It confines its attention to frequencies which are usable for radio communications; it does not cover infra-red, ultraviolet or visible radiation (light) nor does it take account of extra-low frequency (ELF), very-low frequency (VLF) or low-frequency (LF) radiation.

It is not that these categories of radiation are not in use. They are amongst the most widely used frequencies covering such things as the electrical power frequency (50 Hz) and its harmonics, telephone and telegraph frequencies and some radio frequencies other than broadcasting, but these communication frequencies are commonly used at comparatively low power. Power frequencies and frequencies producing audible sound and ultrasound are the responsibility of other SAA committees.

The purpose of the standard is to provide guidance on the exposure of the human body to radio-frequency radiation and to set limits intended to avoid the production of effects hazardous to the body, based on current knowledge of biological effects of radiation in the frequency range of 300 kHz to 300 GHz. The standard applies to the exposure of radiation workers due to their employment and the incidental exposure of the general public, but it does not apply to patients undergoing medical diagnosis or treatment.

During the preparation of this standard, reference was made to hundreds of papers and summaries on research into this problem and also to most of the medical, occupational and national standards published or in preparation. The standard takes a position below those standards which have published exposure limits based on firm scientific evidence of adverse effects to the body. Moreover it is recommended that the level of all electromagnetic fields should be kept as low as reasonably achievable.

The ALARA (as low as reasonably achievable) Principle was introduced by the International Commission on Radiological Protection (ICRP) in 1965 in ICRP Publication 9. The Commission has maintained its view since that time that '**all dose should be kept as low as reasonably achievable, economic and social considerations being taken into account**'. Implications relating to these principles are given in ICRP Publication 22 and in ICRP Publication 26. The philosophy takes into account the risks of radiation exposure, benefits to be derived from a given practice and the costs associated with further reductions of exposure.

The occupational (8-hour) limits in the range from 30 MHz to 300 MHz are similar to those proposed by the International Radiation Protection Association, the American National Standards Institute, the National Radiation Protection Board of UK and the Council for Europe, which were among the standards consulted. A rationale explaining the reasons for adoption of the major proposals is included as Appendix A.

By analogy with the approach adopted for ionizing radiation in Australia, the non-occupational (24-hour) limit averaged over a time of 1 min has been set arbitrarily at one-fifth of the occupational limit, as justified in the guidelines on limits of exposure to radio-frequency electromagnetic fields in the frequency range from 100 kHz to 300 GHz developed by the International Radiation Protection Association in cooperation with the Environmental Health Division of the World Health Organization.

AS 3301, Approval and Test Specification for Particular Requirements for Microwave Ovens, specifies levels different to those contained in this standard. As AS 3301 is based on IEC 335-2-25 its limits and methods of measurement are those specified in the IEC standard and may not be directly related to those specified in this standard.

It is intended that this standard will have a limited life and will be reviewed within three years on the basis of evidence gained during its application and from research on the subject which is now world-wide.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

RADIO FREQUENCY RADIATION ~~MAXIMUM EXPOSURE LEVELS—RADIO FREQUENCY RADIATION—~~

~~300 kHz TO 300 GHz~~

Part 1 - MAXIMUM EXPOSURE LEVELS — 300 kHz TO 300 GHz

FOREWORD

Advances in science and technology may change man's environment introducing new factors which, besides their intended beneficial uses, may also have untoward side effects. The dangers of pollution of air and water, ionizing radiation and noise and the need to take appropriate steps for effective control are widely appreciated. The effect on health of the increasing use of devices producing electromagnetic fields is not nearly so well understood. The reasons which guided the preparation of this standard, as summarized in the Environmental Health Criteria, No 16, Radiofrequency and Microwaves, published by the World Health Organization, are briefly stated:

General population exposure to man-made sources of radio-frequency radiation now exceeds that from natural sources by many orders of magnitude. The rapid proliferation of such sources and the substantial increase in radiation levels is causing considerable concern over the likely hazards known to be caused by electromagnetic radiation under particular circumstances. Major man-made sources in this frequency range include radio and telecommunication equipment, industrial, commercial and domestic equipment, particularly where it is used for heating purposes. Radiation from high powered sources propagates over large distances. Increased levels of environmental electromagnetic radiation may soon constitute a problem in many countries.

At the Warsaw International Symposium on biological effects and health hazards of microwave radiation in 1973 it was agreed that radio-frequency power densities could be divided into the following ranges:

(a) High power densities, generally greater than 10 mW/cm^2, at which distinct thermal effects predominate.

(b) Medium power densities, between 1 mW/cm^2 and 10 mW/cm^2, where weak but noticeable thermal effects exist.

(c) Low power densities, below 1 mW/cm^2 where thermal effects do not appear to exist but other effects have been reported.

When sufficient radio-frequency radiation is absorbed by an organism it can be converted into heat with a consequent rise in temperature. Studies on injuries to animals resulting from high levels of radiation show a variation from lesions in specific organs to gross thermal stress from hyperthermia. Death may follow exposure to power densities as low as 30 mW/cm^2 depending on the size of the animal and the duration of radiation.

Acute exposures may cause injury to the eye. The cornea and crystalline lens are particularly susceptible to frequencies in the 1 GHz to 300 GHz range. For short-term exposures the cataractogenic incident power densities lie in the 150 mW/cm^2 to 200 mW/cm^2 range. Cataract formation may be induced in animals by as little as 1-hour exposure at such levels. The formation of retinal lesions is also possible.

It has also been demonstrated that low-level, long-term exposure can induce a variety of effects in the nervous, haematopoietic and immune systems of small animals. Such exposure may influence the susceptibility of animals to other influencing factors. Thermal mechanisms seem inadequate to account for these and other effects.

Other factors that must also be considered include the frequency, pulsing or modulation of the radiation and whether resonance occurs in the body or part of the body. The need for additional research aimed at clarification of the underlying mechanisms of these subtle effects is receiving attention in many countries but not a great deal is known about subjective effects in man. Summaries of current thinking given in such publications as the WHO Environmental Health Criteria No 16, Radiofrequency and Microwaves, and Biological Effects of Radiofrequency Radiation of the US Environmental Protection Agency 1983, are recommended for a concise overview of the recent situation.